A classical statue of Euclid, an ancient Greek mathematician, is shown from the waist up, leaning forward with his head down. He is wearing a red robe over a yellow garment. The background is a dark space filled with a grid of glowing yellow light rays, some of which curve upwards and to the right, suggesting a gravitational field or curvature of space-time. The overall composition is a blend of classical art and modern scientific concepts.

Euclid

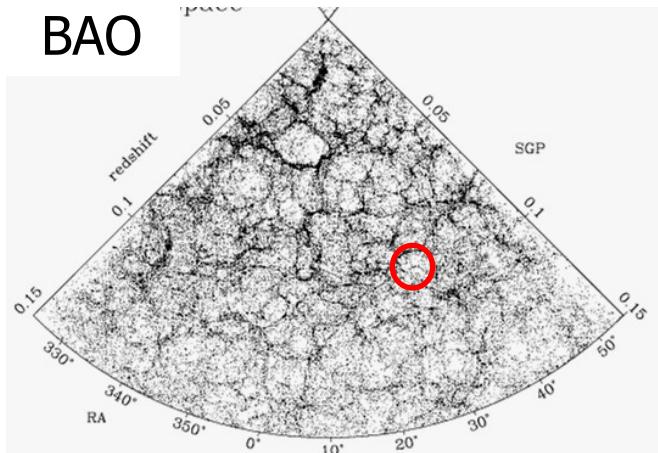
Y. Mellier

# Euclid: primary probes

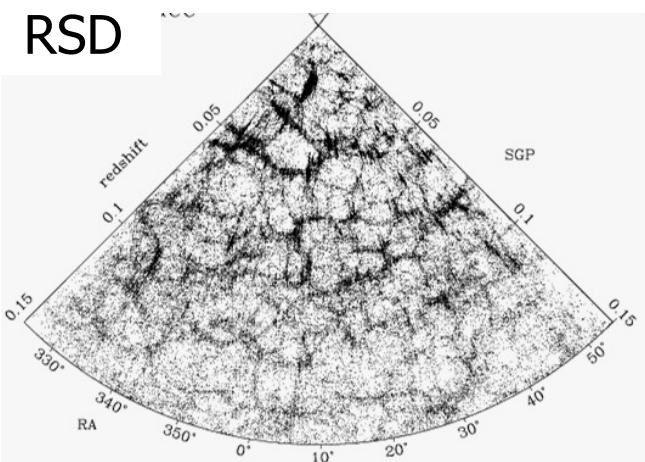
## BAO, RSD and WL over 15,000 deg<sup>2</sup>

50 million galaxies with redshifts

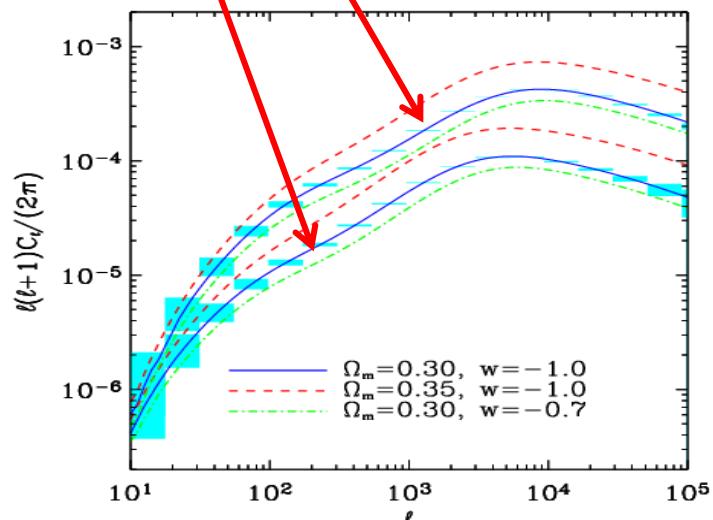
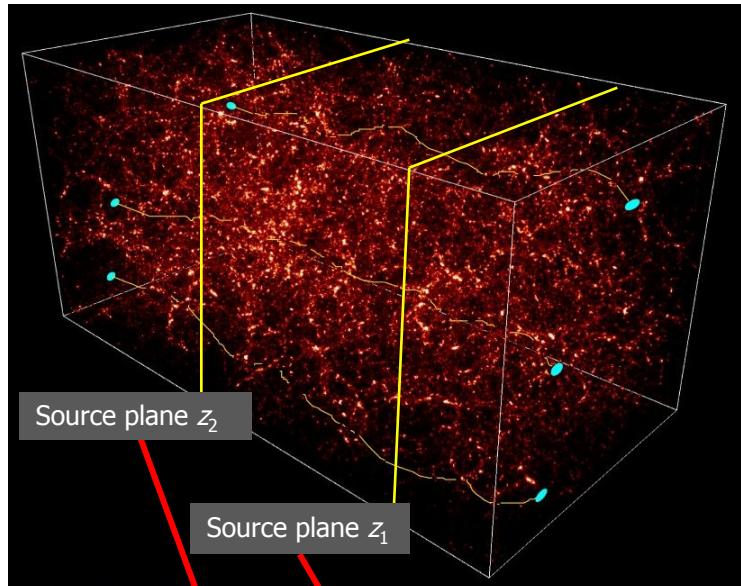
BAO



RSD



1.5 billion sources with shapes, 10 slices



# Euclid mission baseline: Launch in 2020

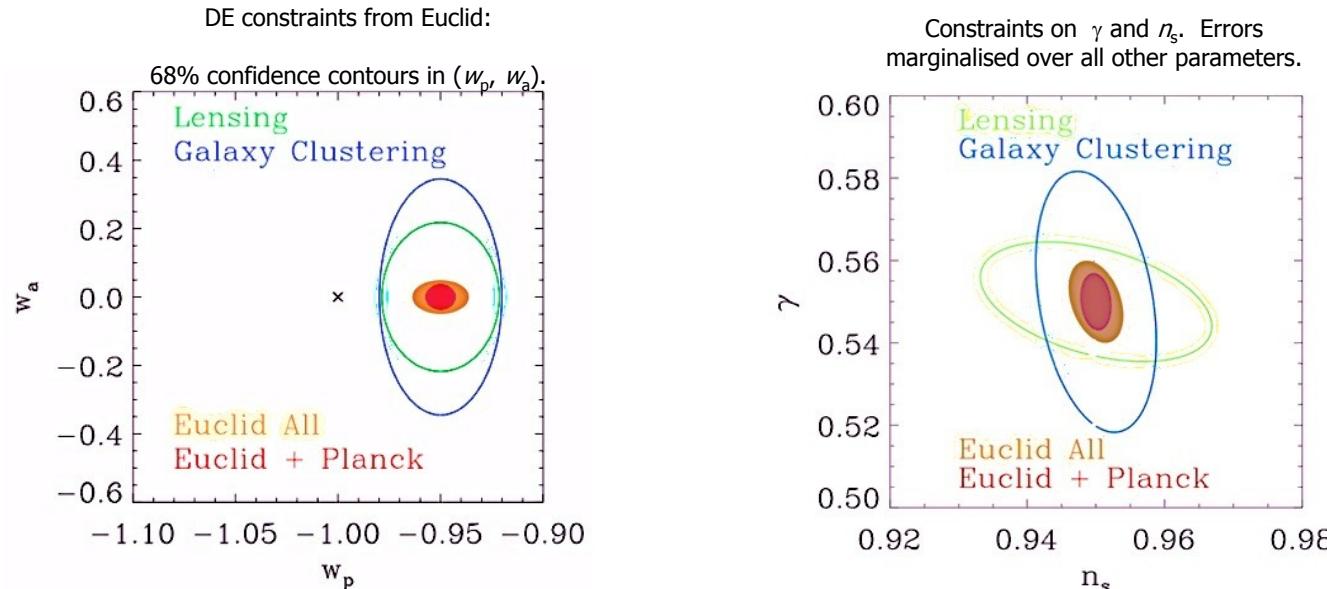
**Photo-z:** Ground based Photometry and Spectroscopy

		SURVEYS	In ~6 years					
	Area (deg2)	Description						
Wide Survey	<b>15,000 deg<sup>2</sup></b>	Step and stare with 4 dither pointings per step.						
Deep Survey	<b>40 deg<sup>2</sup></b>	In at least 2 patches of > 10 deg <sup>2</sup> 2 magnitudes deeper than wide survey						
<b>PAYOUT</b>								
Telescope	1.2 m Korsch, 3 mirror anastigmat, f=24.5 m							
Instrument	VIS	NISP						
Field-of-View	0.787×0.709 deg <sup>2</sup>	0.763×0.722 deg <sup>2</sup>						
Capability	Visual Imaging	NIR Imaging Photometry			NIR Spectroscopy			
Wavelength range	550– 900 nm	Y (920-1146nm),	J (1146-1372 nm)	H (1372-2000nm)	1100-2000 nm			
Sensitivity	24.5 mag 10σ extended source	24 mag 5σ point source	24 mag 5σ point source	24 mag 5σ point source	$3 \cdot 10^{-16}$ erg cm-2 s-1 3.5σ unresolved line flux			
Shapes + Photo-z of $n = 1.5 \times 10^9$ galaxies			z of $n = 5 \times 10^7$ galaxies					

**Possibility other surveys:** SN and/or μ-lens surveys, Milky Way ?

Ref: Euclid RB Laureijs et al arXiv:1110.3193

# Euclid: forecasts primary cosmology programme

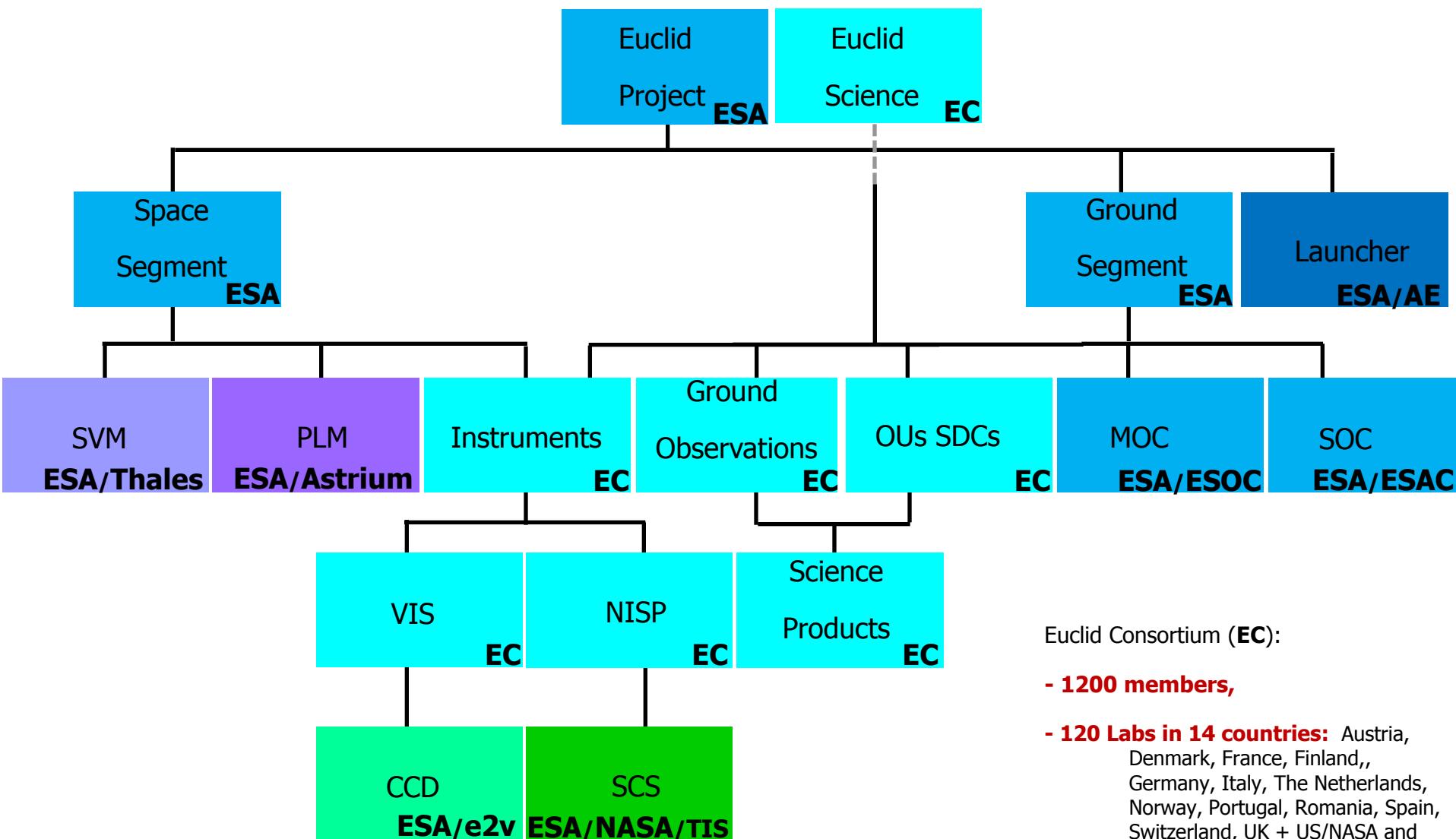


	Modified Gravity	Dark Matter	Initial Conditions	Dark Energy		
Parameter	$\gamma$	$m_\nu$ /eV	$f_{NL}$	$w_p$	$w_a$	FoM
Euclid primary (WL+GC)	0.010	0.027	5.5	0.015	0.150	430
Euclid All	0.009	0.020	2.0	0.013	0.048	1540
Euclid+Planck	0.007	0.019	2.0	0.007	0.035	4020
Current (2009)	0.200	0.580	100	0.100	1.500	~10
<b>Improvement Factor</b>	<b>30</b>	<b>30</b>	<b>50</b>	<b>&gt;10</b>	<b>&gt;40</b>	<b>&gt;400</b>

Ref: Euclid RB arXiv:1110.3193

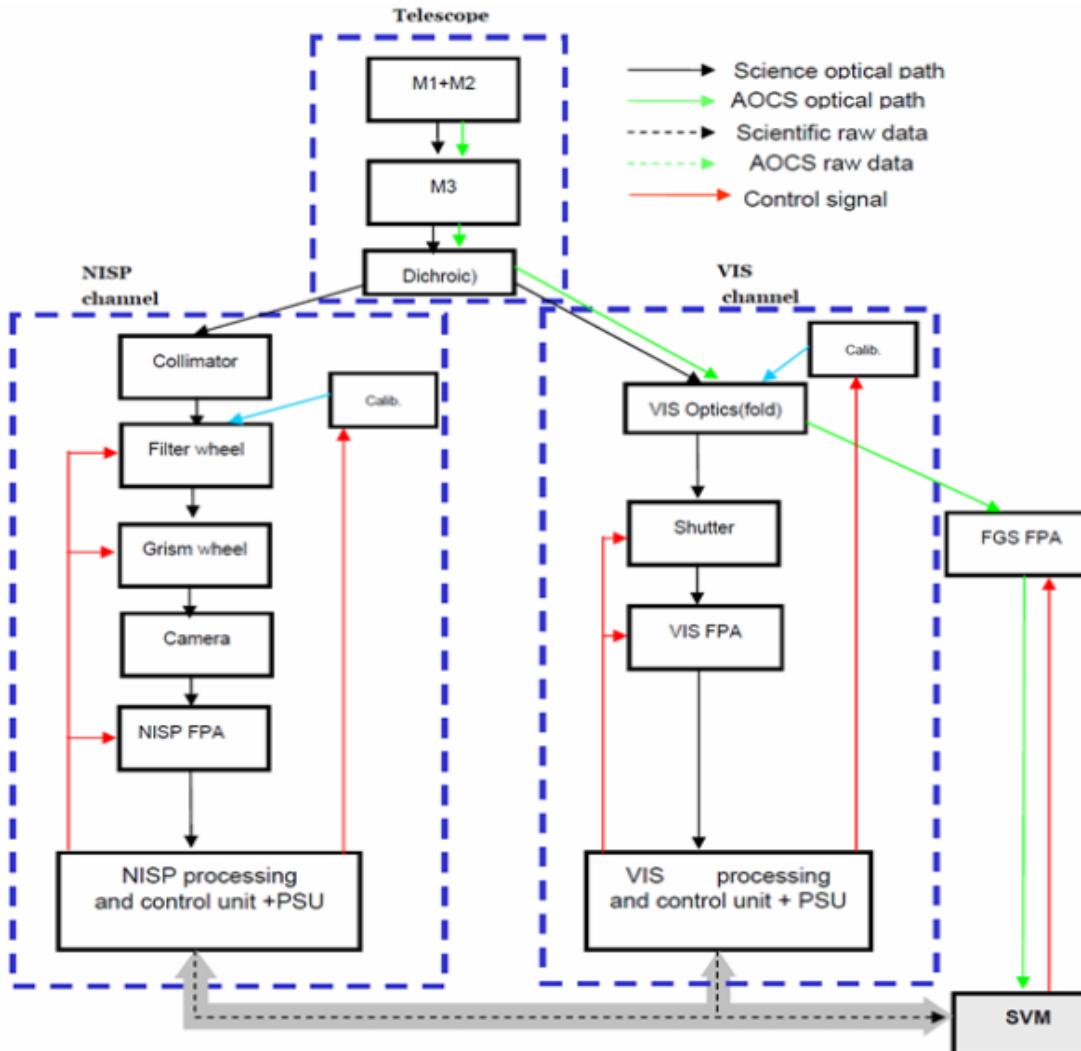
Assume systematic errors are under control

# Euclid Collaboration



Euclid Consortium (EC):  
- **1200 members,**  
- **120 Labs in 14 countries:** Austria, Denmark, France, Finland, Germany, Italy, The Netherlands, Norway, Portugal, Romania, Spain, Switzerland, UK + US/NASA and Berkeley labs.

# Euclid: payload block diagram



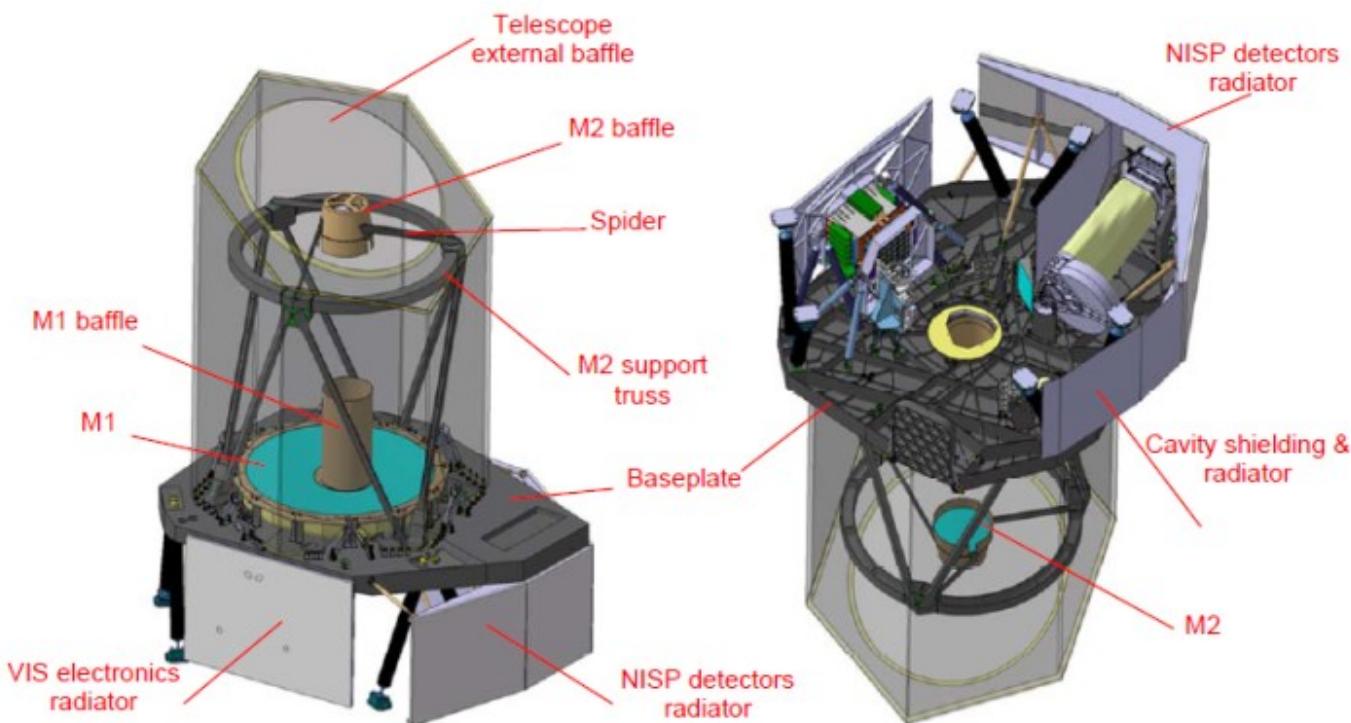
FGS FPA = Fine Guidance Focal Plane Array: mounted on the VIS FPA and part of the Attitude and Control Orbit System (AOCS)

# Euclid: status

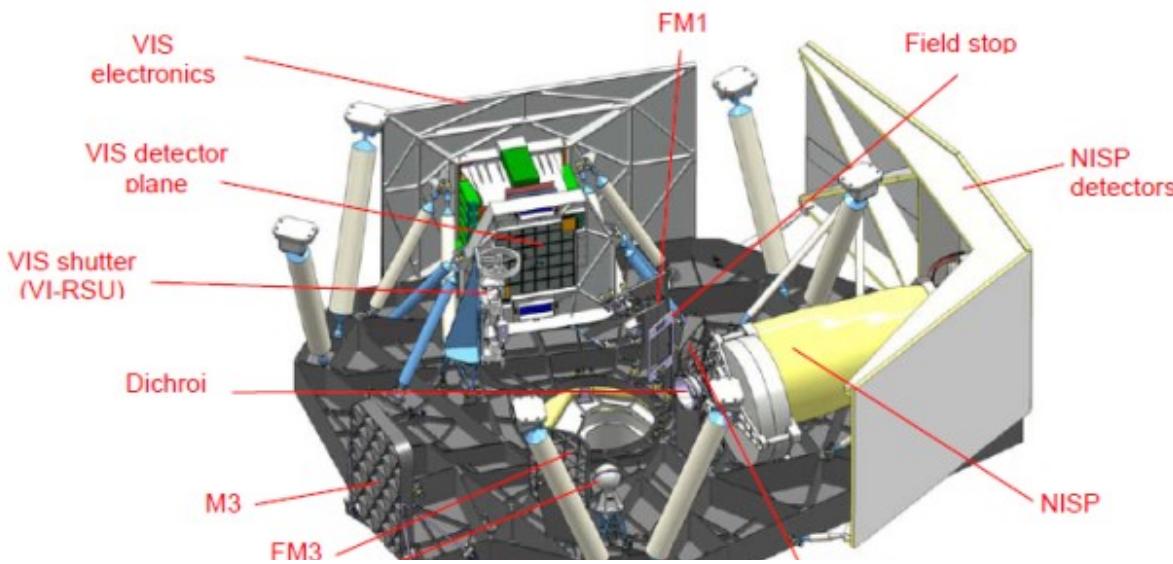
- Astrium France Toulouse selected as PLM
- Thales Alenia space selected as prime contractor and SVM
- Thales/ESA Kick off in early July 2013
- VIS and NISP : SRR review in July 2013 → authorised to move to PDR
- NIR Detector PDR passed in July 2013
- SGS : PRR review in July → authorised to move to SRR
- Euclid releases: updated in June 2013. Approved by ESA

# Euclid:

## PLM telescope and instruments



Astrium



Euclid

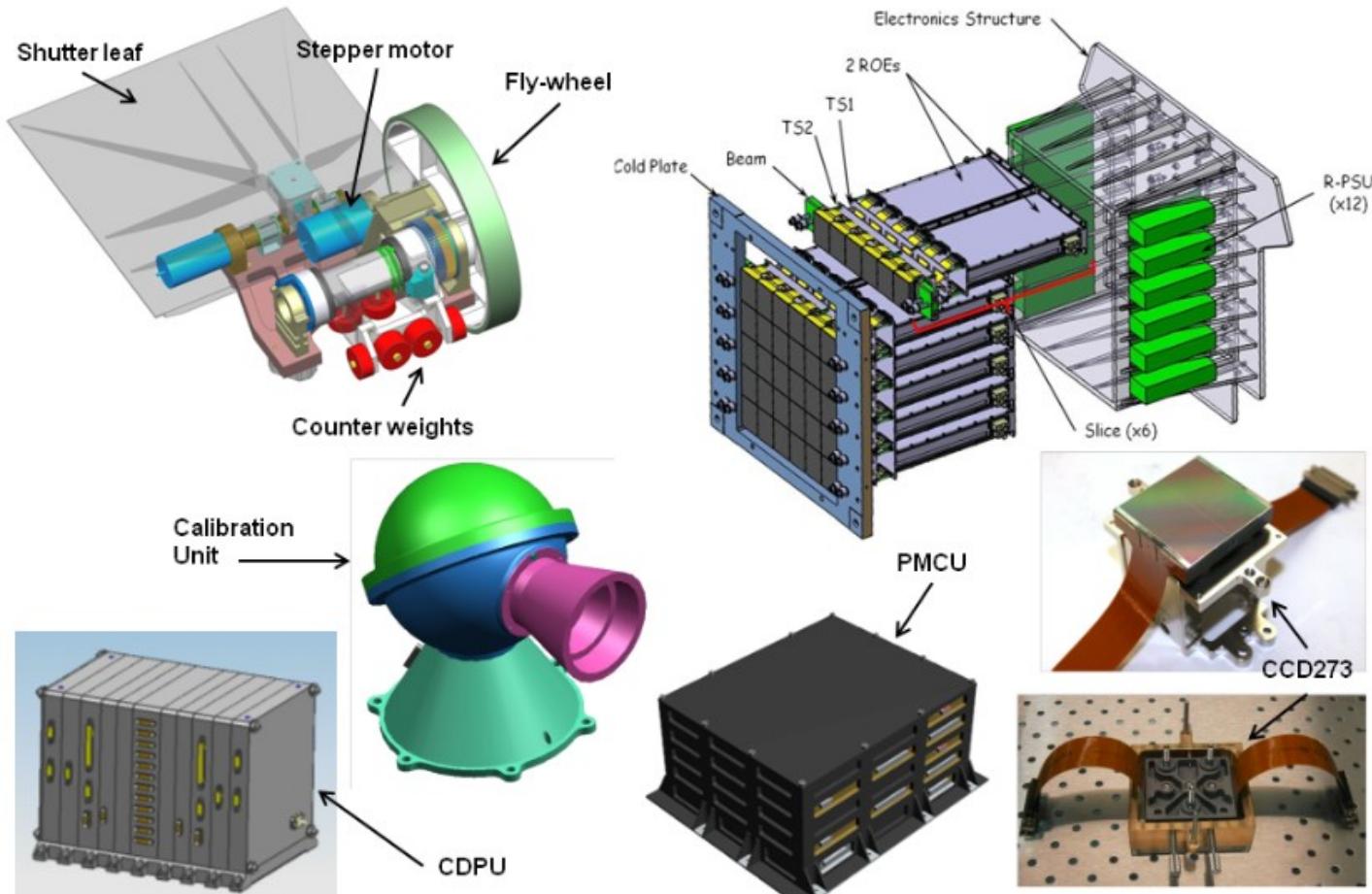
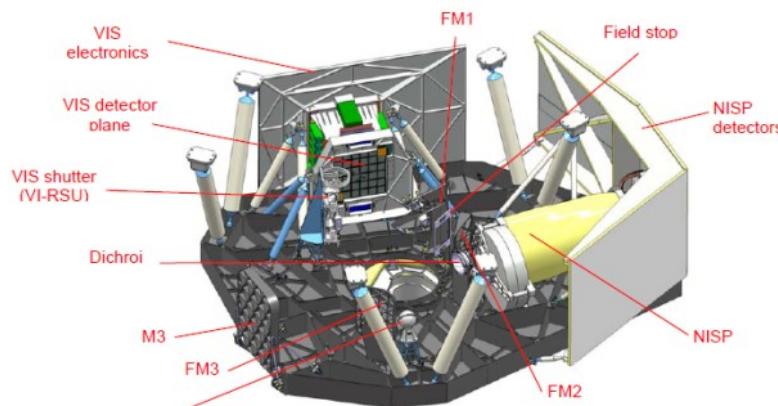
WFIRST meeting

- Stabilisation:  
Pointing error along the x,y axes= 25mas over a period 600 s.
- FoV:  
Common visible and NIR Fov =  $0.54 \text{ deg}^2$

# VIS instrument

Courtesy: S. Pottinger, M. Cropper and the VIS team

- large area imager – a 'shape measurement machine'
- 36 4kx4k CCDs with 12 micron pixels
- 0.1 arcsec pixels on sky
- bandpass 550-900 nm (wide band channel)
- limiting magnitude for wide survey of magAB = 24.5 for  $10\sigma$  (extended)
- data volume – 520Gbit/day



# EC VIS Milestones

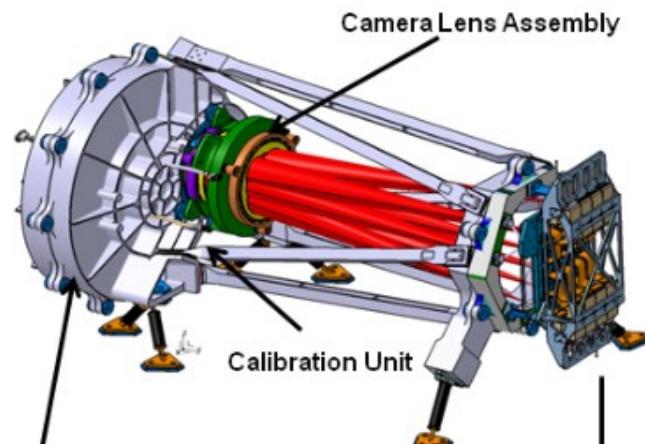
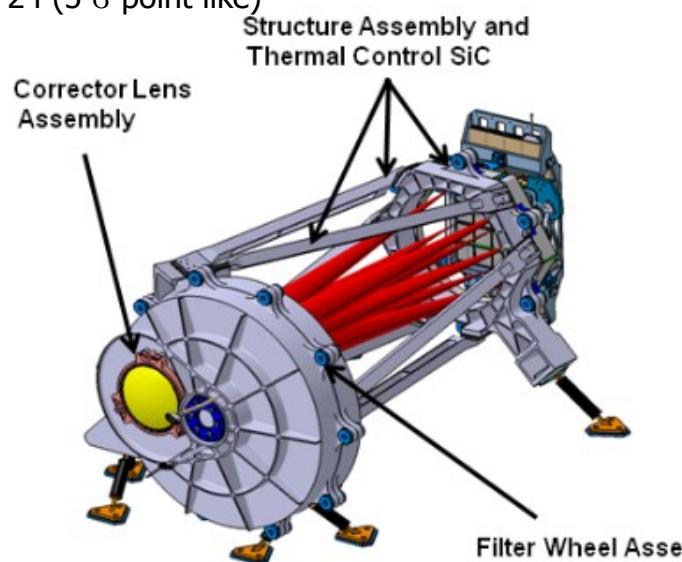
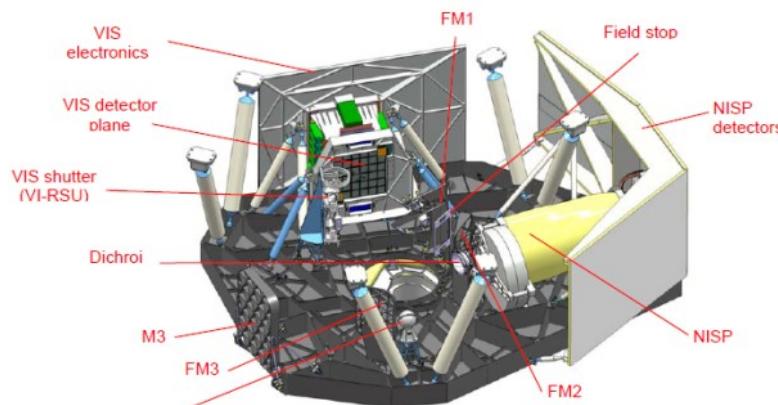
Review	Date	Objectives/Drivers
ISRR	June 2013 <b>→ Go for PDR.</b>	<ul style="list-style-type: none"><li>• Complete requirements flowdown</li><li>• Optimisation &amp; refinement based on design evolution and input from PLM</li></ul>
IPDR	February 2014	Design evolution based on outputs from ISSR and continuing development
ICDR	August 2015	Date defined by hardware manufacturing lead time
IFAR	July 2017	Confirm readiness to deliver flight model on time with required performance

- VIS delivery dates tentative
  - STM : 21/09/2015 (02/02/2016) (IDCR: 06/2015)
  - EM : 09/02/2016 (26/09/2016) (IDCR: 09/2015)
  - FM : 22/07/2017 (22/07/2017) (IDCR: 02/2017)
- FM CCD need dates tentative
  - 1st ROE set (i.e. delivery of 3rd FM device) - 01/03/2016
  - 12th ROE set (i.e. delivery of 36th FM device) - 08/07/2016

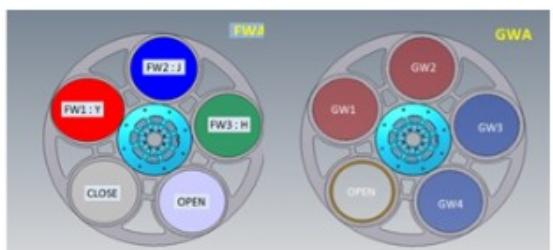
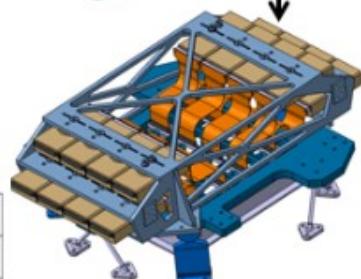
# NISP instrument

Courtesy: T. Maciaszek and the NISP team

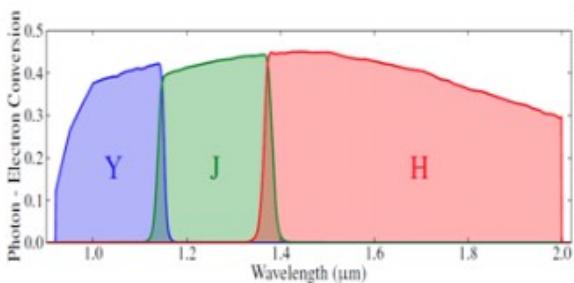
- 16 2kx2K H2GR NIR detectors
- 0.3 arcsec pixel on sky
- 3 Filters: Y, J, H
- 4 grisms: 2B, 2R
- Limiting magAB: 24 (5  $\sigma$  point like)



Grism Wheel Assembly



Filters and grisms positions in wheels



NISP throughputs through the Y, J and H filters

# EC NISP Milestones

Review	Date	Objectives/Drivers
ISSR	July 2013 → Go for PDR.	<ul style="list-style-type: none"><li>• Complete requirements flowdown</li><li>• Optimisation &amp; refinement based on design evolution and input from PLM</li></ul>
IPDR	January 2014	Design evolution based on outputs from ISSR and continuing development
ICDR	January 2015	Date defined by hardware manufacturing lead time
IFAR	July 2017	Confirm readiness to deliver flight model on time with required performance

NISP delivery dates (tentatives)

STM : 18/12/2015 (IDCR: 18/12/2015)

AVM : 17/06/2016 (IDCR EM: 17/06/2016)

FM : 21/07/2017 (IDCR 21/07/17)

FM SCS # 1 to 16 : 10/11/2014 to 16/06/2015

# Simulations of strong lenses observed with Euclid

CFHTLS-w

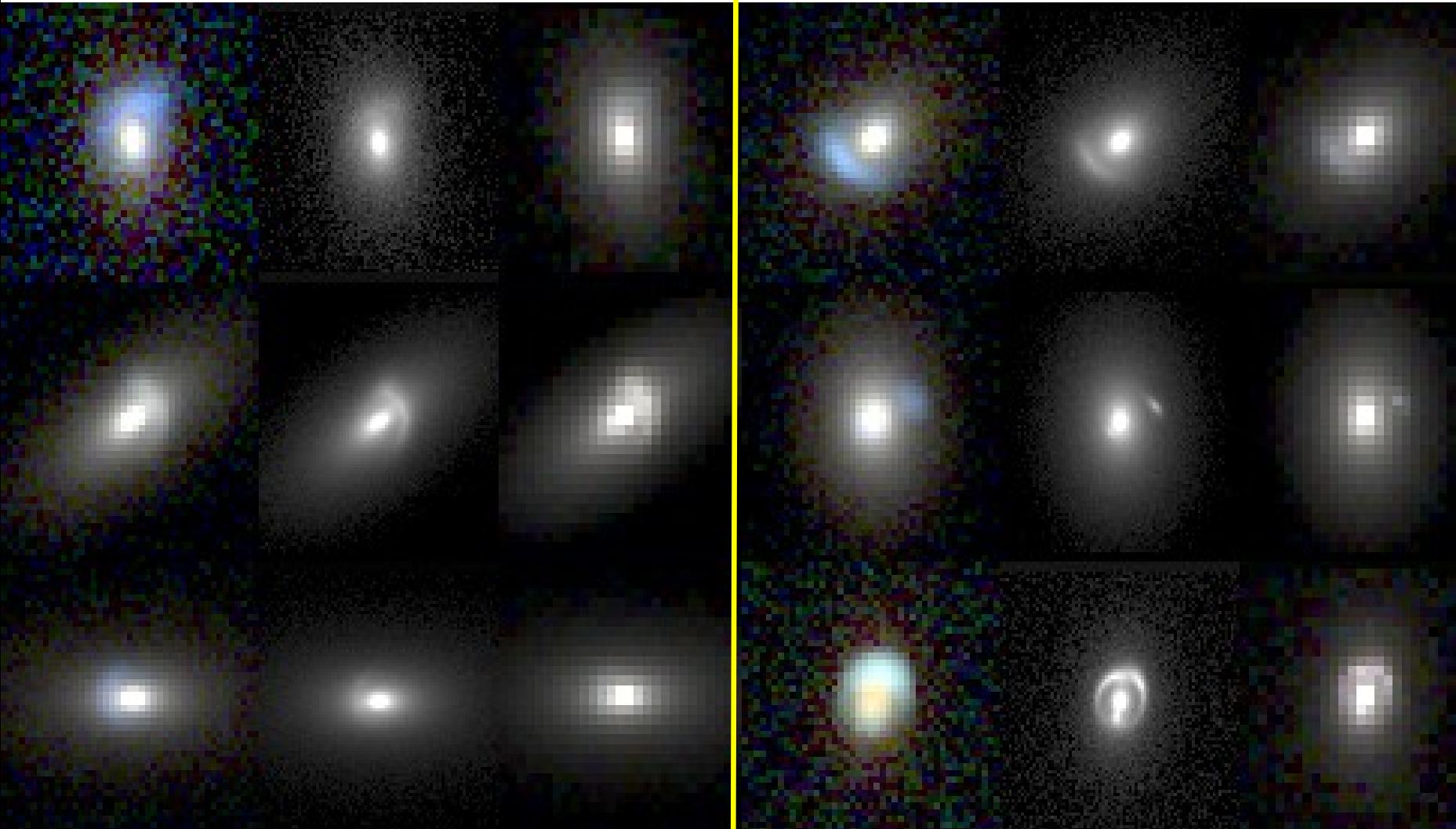
R+I+Z

YJH

CFHTLS-w

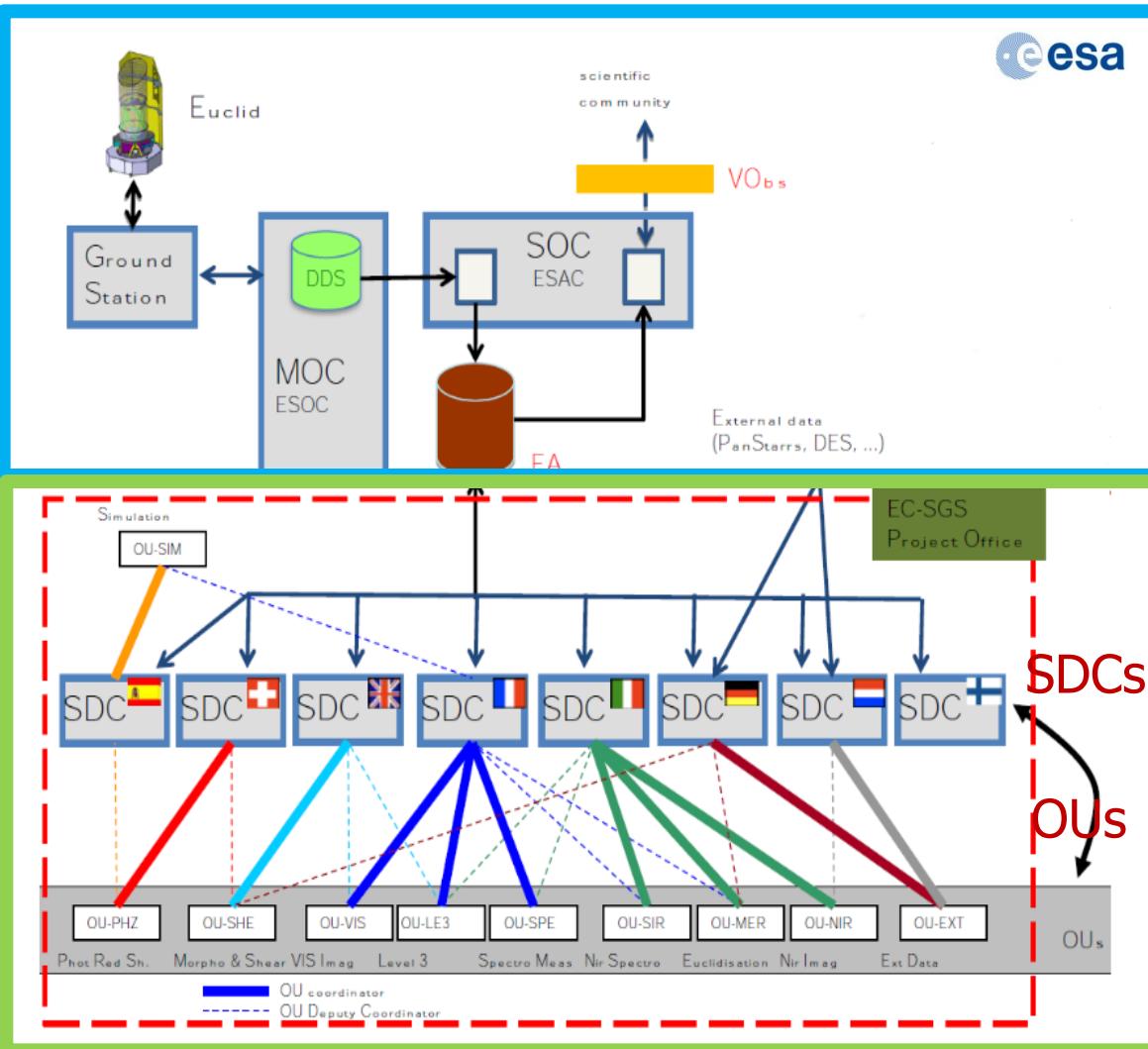
R+I+Z

YJH



# Euclid: Science Ground Segment:

passed PRR in July 2013 → go to SRR



Courtesy: F. Pasian, M. Sauvage, J. Hoar, C. Dabin EC SGS and ESAC

## Complex organisation:

- 10 Organisation Units
- 7 Science Data Centers

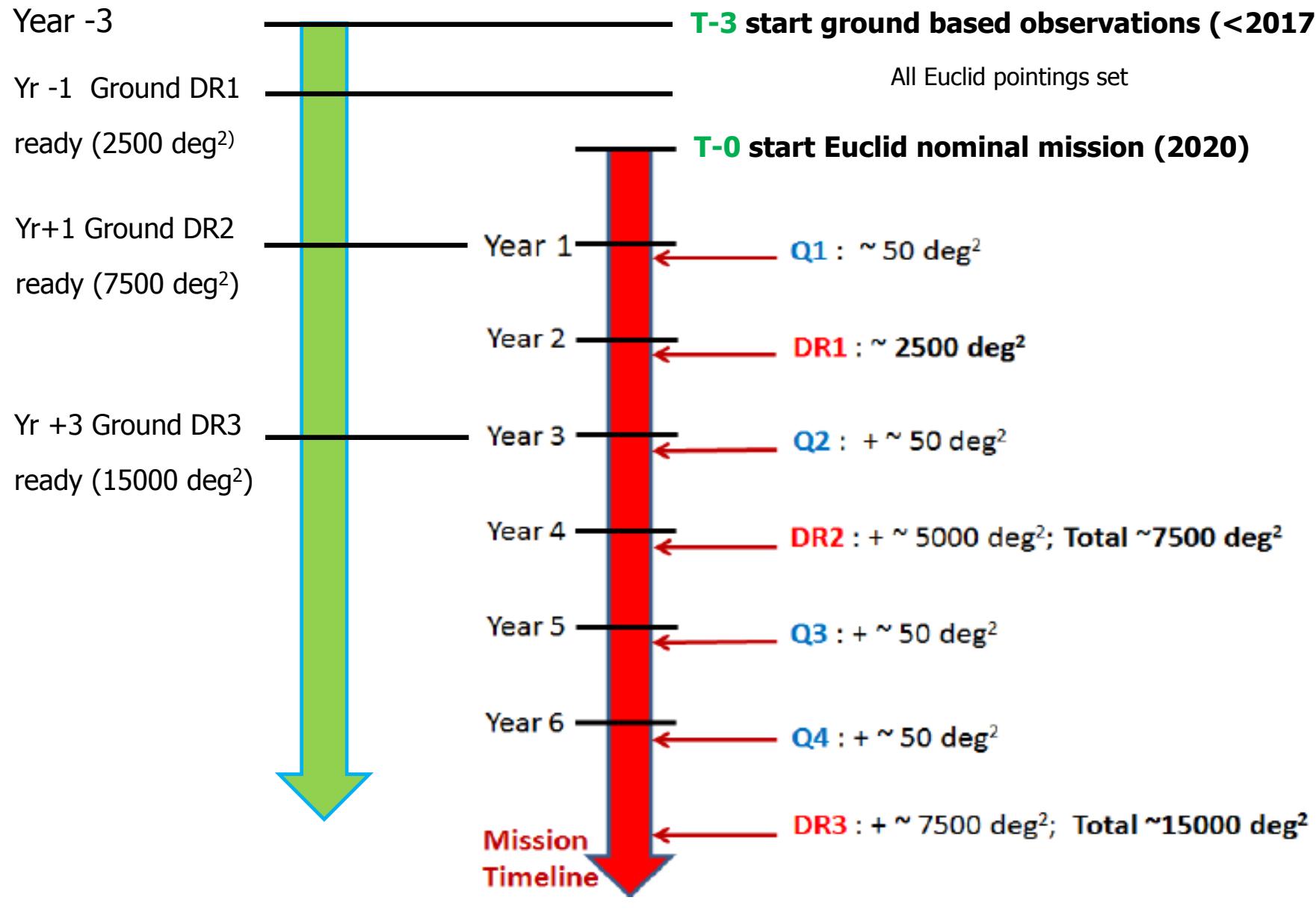
**Data:** huge volumes, heterogeneous data sets

- imagery and morphometry, photometry , spectroscopy
- data from ground and space
- 20-30 Pbytes
- $> 10^{10}$  sources ( $> 3$ -sigmas)

**1st release Level-3:** 26 months after the begining of the survey.

SGS = 50% of Euclid Consortium contributions.

# Data release: ground based + Euclid



# Euclid: next steps (coming year)

- Astrium France Toulouse selected as PLM
- Thales Alenia space selected as prime contractor and SVM
- Thales/ESA Kick off in early July 2013
- VIS and NISP : SRR review in July 2013 → authorised to move to PDR
- NIR Detector PDR passed in July 2013
- SGS : PRR review in July → authorised to move to SRR
- Euclid releases: updated in June 2013. Approved by ESA.
- MRR in Dec. 2013
- VIS and NISP PDR in Jan.- March 2014
- SGS SRR in Dec. 2014
- Decisions on additional surveys in 2015 (SN<sub>Ia</sub>, mu-lens, Galaxy,...)

# Euclid: schedule

